GAYMAR®

T/PUMP®

REF TP472

Heat Therapy System

CE
0086

SERVICE MANUAL

P/N 11205-000 5/01

BEFORE YOU BEGIN . . .

READ AND UNDERSTAND THIS T/PUMP SERVICE MANUAL AND ALL PRECAUTIONS (SEE PAGE 2) PRIOR TO SERVICING THE T/PUMP.

The purpose of this manual is to provide operation, service, and repair information for GAYMAR heat therapy pumps.

Only qualified medical service personnel should repair the T/Pump, in accordance with the *TP472 T/Pump Service Manual*. Contact your local dealer or Gaymar's Technical Service Department for assistance.

Telephone: (716) 662-8636

Fax: (716) 662-0730

RECEIVING INSPECTION

Upon receipt, unpack the T/Pump. Save all packing material. Perform a visual and mechanical inspection for concealed damage. If any damage is found, notify the carrier at once and ask for a written inspection. Photograph any damage and prepare a written record. Failure to do so within 15 days may result in loss of claim.

Contact your local dealer for assistance.

WARRANTIES

The TP472 T/Pump is warranted free of defects in material and workmanship for a period of one (1) year, under the terms and conditions of the Gaymar warranty in place at the time of purchase. A copy of the warranty is available upon request. Gaymar disclaims all implied warranties including, but not limited to, the implied warranties of merchantability and of fitness for a particular purpose.

T/PUMP, T/PAD, Mul•T•Pad, and Clik-Tite are registered in U. S. Patent and Trademark Office. U. S. PATENT 4,068,870
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⚠ DANGER

- **Risk of electric shock.** Disconnect power before servicing the T/Pump.

⚠ WARNING

- This device pumps warmed water through a pad. Set pad temperature only as prescribed by and under the guidance of a physician. Monitor the patient's temperature and skin condition every 20 minutes or as directed by a physician. **Failure to adhere to these warnings could result in patient injury.**

  The following Groups/Conditions require additional surveillance:

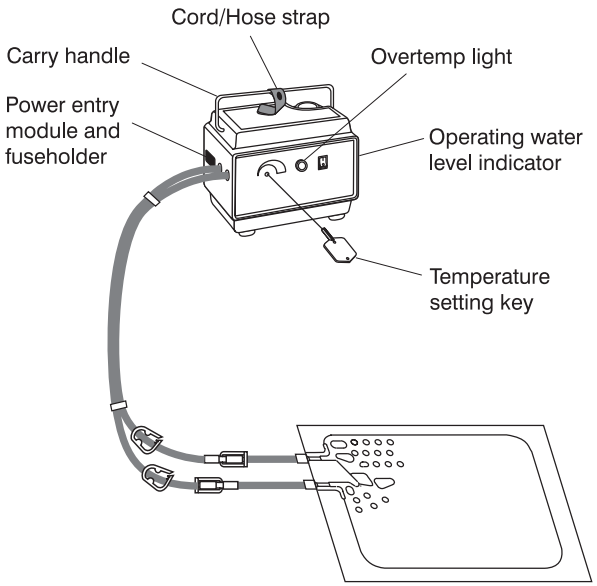
Group/Condition at risk	Potential injury
Pediatric patients	Hyperthermia/ hypothermia
Patients with impaired circulation	Ischemia
Areas of application are under pressure	Ischemia
In combination with topical solutions whose toxicity may be affected by the application of heat	Chemical injury
In combination with other heat sources	Thermal injury

- Only qualified medical service personnel should repair the T/Pump. **Improper repair may result in death or serious injury, equipment damage, or malfunction.**
- Always perform the *FUNCTIONAL CHECK AND SAFETY INSPECTION* (pp. 9-13) after making repairs and before returning the T/Pump to patient use. Document your findings on the *INSPECTION FORM* (p. 14). **Improper repair may result in death or serious injury, equipment damage, or malfunction.**

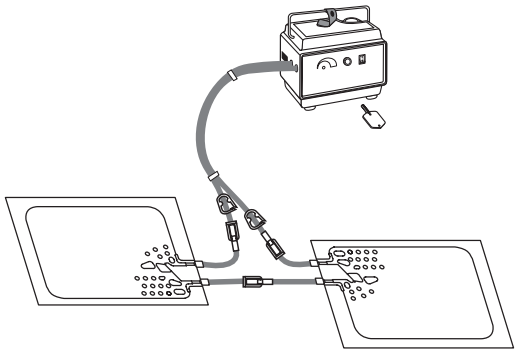
⚠ CAUTION

- Do not perform any powered tests with the reservoir empty. **Damage to the T/Pump may result.**

Figure 1 - T/PUMP HEAT THERAPY SYSTEM



Single Pad



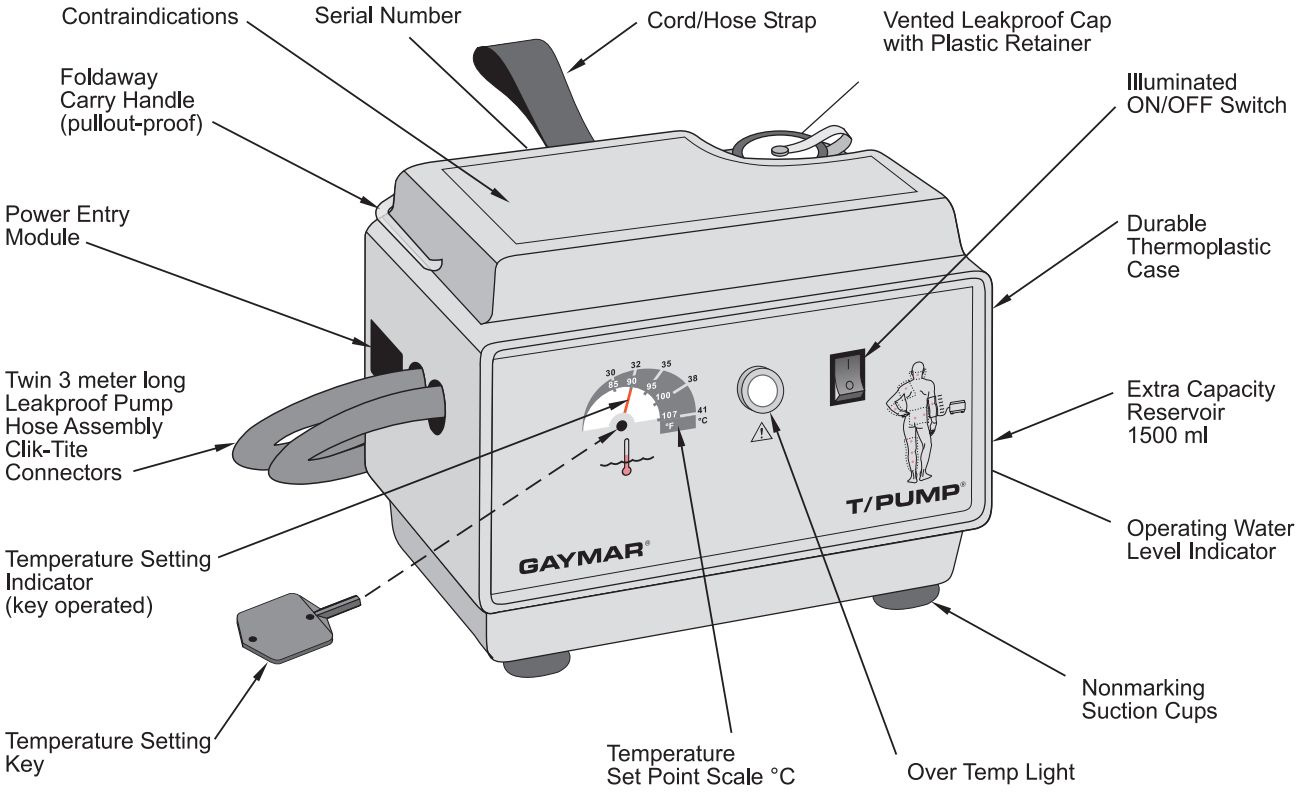
Multiple Pads

The Gaymar T/Pump Heat Therapy System provides a means of applying heat therapy by supplying temperature-controlled water through a connector hose to a Gaymar T/Pad®. The hose is terminated in easy-to-use Clik-Tite® connectors.

The T/Pad provides the interface for delivering the heat therapy. The unique button design allows water to flow and provides trouble-free operation when the pad is folded. The pads are applied to the part of the body requiring heat therapy, and the circulating water maintains the pad at the set point temperature.

The T/Pads can be interconnected to provide therapy to more than one body site at a time.

Figure 2 - T/PUMP FEATURES / SPECIFICATIONS



FEATURES

Temperature Setpoint Range	30-41°C, exiting water temperature from pump; accuracy, ±1°C at 41°C. Key-operated to prevent tampering.
Tip-over Switch	Turns heater off if pump is tipped. NOTE: This does not activate the *OVER TEMP* light.
OVER TEMP Light	Indicates the pump and heater have been turned off. This light is activated by the two *OVER TEMP* safety thermostats. Refer to the *TROUBLESHOOTING* section.
OVER TEMP Safety Thermostats	Either of two limit thermostats will shut off pump and heater if the high temperature limit is exceeded. The *OVER TEMP* light will glow. Refer to *TROUBLESHOOTING* section.
Operating Water Level Indicator	Clear window allows viewing of the reservoir water level.

SPECIFICATIONS

Reservoir capacity	1500 ml maximum
Detachable power cord	Use only an international (harmonized) 3-wire cordset using cordage approved to HD-21 conductor size 1.00 mm^2
Fuses	5x20 mm, 1.6A, Type "T" Sheet 111
Voltage	~220-240
Frequency	50 Hz
Current	1.6A
Ambient operating temperature	15.6°C to 32.2°C
Classification IPXO	Type B, Class 1, grounded equipment suitable for continuous operation. Not classified for protection against harmful ingress of liquid. Equipment not suitable for use in the presence of a flammable anaesthetic mixture with air or with oxygen or nitrous oxide.

WATER TEMPERATURE CONTROL

There are four devices that control the operation of the heater in the GAYMAR T/Pump:

- The temperature controller is thermistor actuated (fig. 3, item 1, p. 7). This controller is adjustable over a temperature range of 30°C to 41°C. The desired water temperature is set with a special removable key (fig. 3, item 3). To prevent unauthorized temperature setting changes, remove the key after the temperature has been set.

- The manifold backup limit thermostat (fig. 3, item 8) is mounted on the brass manifold block (fig. 3, item 7). This thermostat senses water temperature flowing to the pad and will shut off the pump and heater and activate the *OVER TEMP* light if the water temperature exceeds specific limits. The purpose of the manifold backup limit thermostat is to prevent the pump from providing water at too high a temperature to the pad.

- The well backup limit thermostat (fig. 3, item 5) is mounted on the brass plate (fig. 3, item 10) that extends along and under the heater (fig. 3, item 4) near the bottom of the reservoir. This thermostat senses water temperature in the reservoir and will shut off the pump and heater and activate the *OVER TEMP* light if the reservoir temperature exceeds specific limits. The purpose of the well backup limit thermostat is to both prevent the pump from providing water at too high a temperature to the pad and to protect the pump from high temperature damage due to a low water level.

- The tip-over switch (fig. 3, item 2; see also fig. 10, item 4, p. 29) is mounted on the PC board. This mercury-type switch will shut off the heater if the pump is tipped more than 45° from the vertical position.

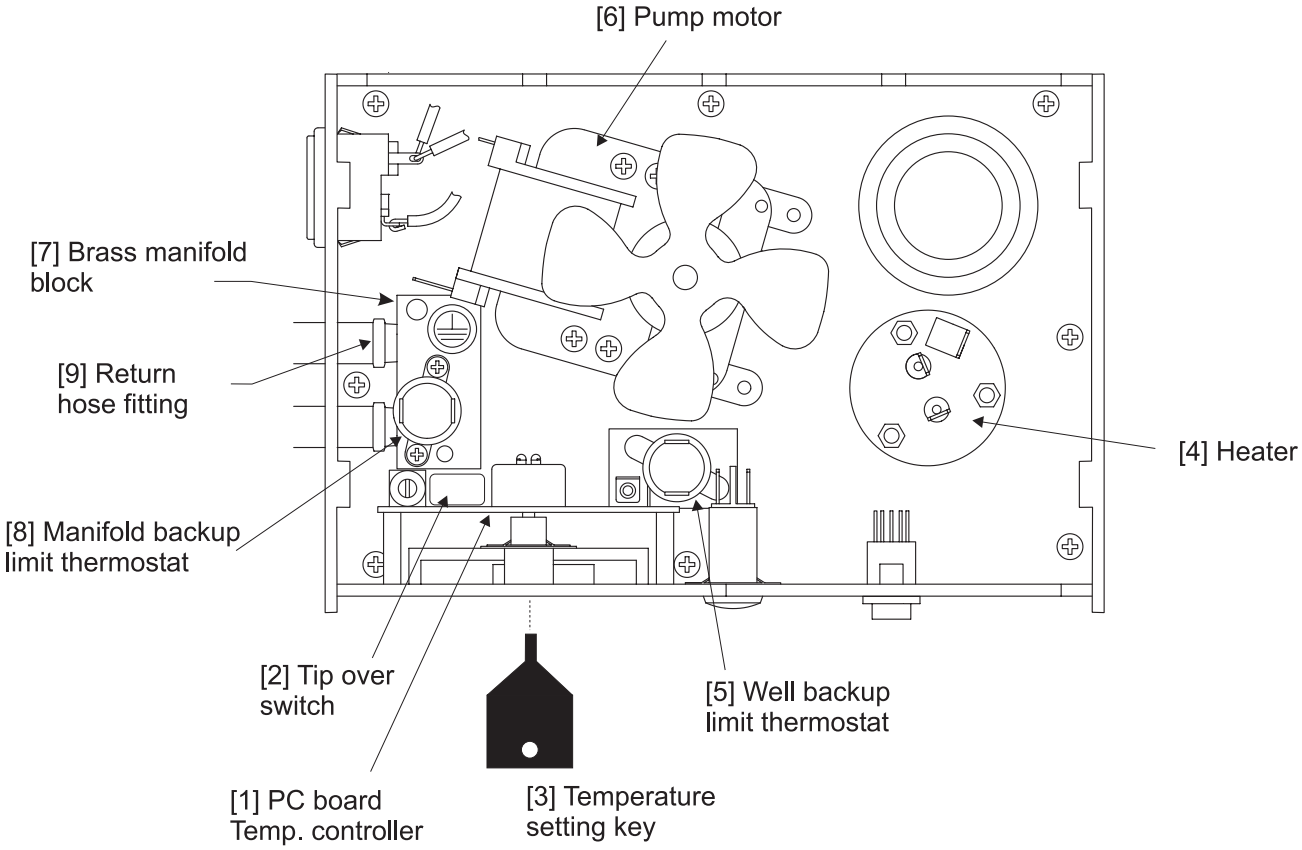
  NOTE: The tip-over switch does not shut off the pump motor or activate the *OVER TEMP* light.

FLUID SYSTEM

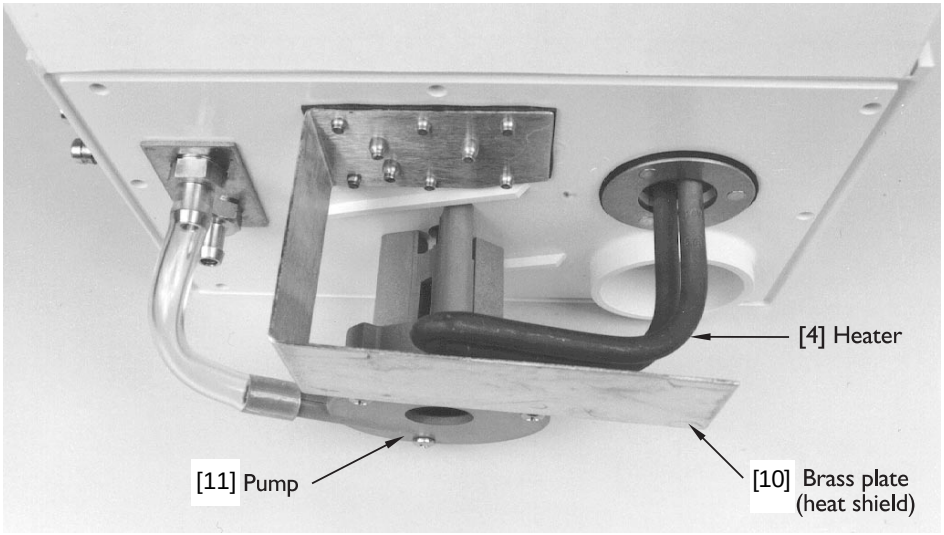
The pump (fig. 3, item 11, p. 7) is a sump configuration driven by an impedance protected, shaded pole AC motor (fig. 3, item 6).

The return hose fitting (fig. 3, item 9) is machined internally to act as an orifice. This maintains a back pressure in the pad to make it resistant to flow restrictions.

FIGURE 3 - T/PUMP COMPONENTS



TOP



BOTTOM

Storage (Short term)

Disconnect pad. Connect ends of the connector hoses together. Open hose clamps. Leave water in the reservoir. To prevent hose kinks, coil the hose rather than folding it. Fasten the hose and cord with strap.

Storage (Long term)

Disconnect pad. Connect ends of the connector hose together. Open hose clamps. Add 1/4 ounce GAYMAR catalog REF MTA33 germicidal or equivalent to water already in reservoir. Run for two (2) minutes. Drain pump. To prevent hose kinks, coil the hose rather than folding it. Fasten the hose and cord with strap and store pump.

Draining

Disconnect the T/Pump from AC power. Disconnect the pad or hoses from one another, keeping hoses at or above the level of the T/Pump. Remove the fill cap and invert the T/Pump over a sink. When all fluid has drained from the hoses and reservoir, replace the fill cap and connect the hoses together.

Cleaning

Unplug the T/Pump prior to cleaning.

To clean the external surfaces, use a non-abrasive cleaning solution (such as warm soapy water) and a damp cloth.

To clean the fluid system, drain the pump. Fill the reservoir to the operating level indicated on the side of the pump. Add 1/4 ounce GAYMAR catalog REF MTA33 germicidal or equivalent. Set the temperature indicator to its lowest setting (fully counterclockwise). Start the T/Pump and circulate the solution for one hour. Drain the solution and refill the pump with distilled water. Using distilled water retards algae growth and mineral buildup.

Change the distilled water monthly or more often depending upon use.

Pads / Accessories

For best results use only GAYMAR T/Pads® or Mul•T•Pads®. The unique button design allows water to flow and provides trouble free operation when the pad is folded. This reduces the number of different sizes of pads your facility must keep in inventory. The T/Pads can be interconnected to provide therapy to more than one body site at a time (see fig. 1, p.3). For a brochure listing the various T/Pads, contact your local GAYMAR dealer.

An optional bed bracket (model TP20A) is available to mount the T/Pump on the footboard of a bed.

FUNCTIONAL CHECK & SAFETY INSPECTION

This section is designed to provide a complete check of all pump parameters. The order of tests should be followed so that the functional testing can be completed in the least possible time.

Follow the *FUNCTIONAL CHECK AND SAFETY INSPECTION* procedures carefully, paying particular attention to test setups. Any deviation from the setups, procedures, or test equipment may result in incorrect or misleading results.

Before making any repairs, be sure to recheck your test setup, procedure, and test equipment.

⚠ DANGER

Risk of electric shock. Disconnect power before servicing the T/Pump.

⚠ WARNING

- Only qualified medical service personnel should repair the T/Pump. **Improper repair may result in death or serious injury, equipment damage, or malfunction.**
- Always perform the *FUNCTIONAL CHECK AND SAFETY INSPECTION* after making repairs and before returning the T/Pump to patient use. Document your findings on the *INSPECTION FORM* (p. 14). **Improper repair may result in death or serious injury, equipment damage, or malfunction.**

⚠ CAUTION

Do not perform any powered tests with the reservoir empty. **Damage to the T/Pump may result.**

INTERVAL

To assure the optimum performance, dependability and safety, the following should be performed once a year (or as specified in the facility's preventive maintenance program) and after making repairs.

REQUIRED TOOLS

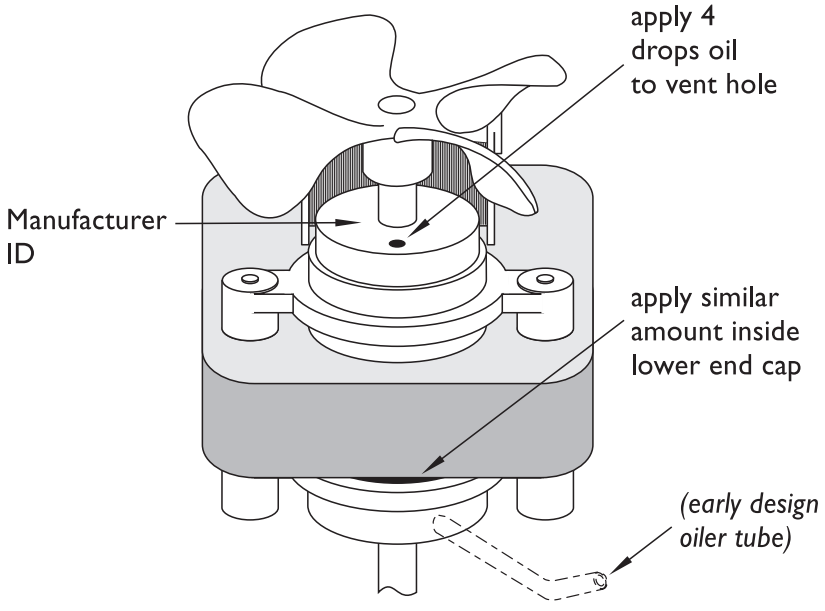
TPT9 ---------- GAYMAR Flow and Temperature Tester
TFC1 ---------- Thermometer, -2°C to 52°C, 1°C accuracy, 30 cm long, 7.5 cm immersion
T/Pad ---------- Any GAYMAR "12" or "22" series T/Pad
TPC1 ---------- GAYMAR T/Pump Test Cover
Ground Resistance Tester
Current Leakage Meter
Distilled Water ---------- 2 liters (approximate)
Synthetic Oil ---------- Anderol 465 (GAYMAR P/N 77137-000)
INSPECTION FORM -------- (p. 14)

1. PHYSICAL CONDITION CHECK

1. Examine the line cord along its entire length for physical damage, such as cuts or cracked insulation. A damaged line cord should be replaced rather than repaired.
2. Operate switches and control settings at all positions. If defective, replace.
3. Visually inspect pump. Check for cracked or damaged plastic parts. **Be sure unit is unplugged.** Remove retainer cap. Remove four (4) screws holding cover and remove cover. (Be sure not to lose fill neck gasket.) Perform visual inspection of all internal parts. Remove any accumulated dirt with a vacuum cleaner or compressed air hose. Leave cover off for balance of inspection.
4. Check Clik-Tite connectors for cracks or missing O rings. Replace connectors if necessary.

2. MOTOR LUBRICATION

1. Locate the motor manufacturer's ID on the top bearing housing. If the pump motor is by Jakel, no oiling is required. If the pump motor is by Uppco, proceed with the following oiling instructions.
2. Oil the pump motor every 6 months with Anderol #465 (GAYMAR P/N 77137-000) or equivalent to extend the life of the T/Pump motor. Do not use a petroleum-based oil since it will leave a residue as it breaks down, causing the motor to seize. Add four (4) drops of oil to the bearing housing of the motor located below the fan. Using a micro oiler, apply a similar amount to the lower bearing at the location indicated in figure 4.



NOTE: Early versions of the pump motor have an oiler tube which does not effectively distribute oil to the lower bearing. Do not use the oiler tube to apply oil to the lower bearing. Use a micro oiler to apply oil directly to the locations shown in figure 4.

Figure 4 - PUMP MOTOR

3. TPC1 TEST COVER INSTALLATION

1. When connecting the test cover do not remove any wiring connections in the T/Pump. Simply clip the test cover alligator clips onto terminals with the same color wire.
2. Connect TPC1 test cover (see fig. 5, p. 21 and fig. 8, p. 24). Always match the color of TPC1 wiring connections to the color of T/Pump wiring. Be sure to keep wires away from fan. Install test cover. Be sure to push cover on tightly. It is not necessary to install screws.
3. Connect pump with test cover, pad and TPT9 flow/temp tester (see fig. 6, p. 22). Be sure the TPT9 is connected to the supply side of the T/Pump, before the pad.
4. Fill unit with room temperature distilled water and replace fill cap. Connect any "12" or "22" series T/Pad. Place pad on an insulating material (e.g., cloth or towel).
5. Set both test cover switches to the *OPEN* position.

4. GROUND RESISTANCE CHECK

⚠ DANGER

Risk of electric shock. Be sure unit is unplugged when performing ground resistance test.

1. Use a ground resistance meter to measure the resistance between the ground pin on the power entry module (fig. 9, item 40, p. 25) and the brass manifold block (fig. 9, item 45). Contact is available through the hole where the hoses connect to the pump. This value should not be more than 0.5 ohm.

5. CURRENT LEAKAGE CHECK

It will be convenient to check current leakage at this point since the unit is full and connected to a pad.

1. Measure the maximum current leakage in all combinations of heater "ON" or "OFF" and power switch "ON" or "OFF." Access to chassis ground for current leakage testing is available through the hole where the hose connects to the pump. The highest reading is typically less than 30 microamperes. The maximum allowable reading is 100 microamperes. Record the highest reading.
2. Disconnect leakage meter setup.

6. TIP-OVER SWITCH CHECK

1. Check the tip-over switch at this point, since the test cover is on and the unit is full. Set temperature to maximum (41°C) on dial. The heater indicator (fig. 5, p. 21) will be on. Tip the unit approximately 45°. If the heater indicator goes out, the tip-over switch is operating. If not, repair or replace the PC board (p. 16). Record results.

7. FLOW RATE TEST

1. Be sure the pad is flat and warm (approximately 41°C) and at the same level as the pump. Top of TPT9 float (see fig. 6, p. 22) should read at least 30 lph. Record reading.

   NOTE: If flow is below 30 lph, refer to *TROUBLESHOOTING* section (p. 20).

8. OPERATING TEMPERATURE TEST

1. Make sure temperature is set to maximum (41°C) on dial. Allow unit to come to a steady temperature, approximately thirty (30) minutes.
2. To ensure accurate temperature readings, add a small amount of water to TPT9 well. Insert thermometer in TPT9 well.
3. Take readings every thirty (30) seconds for five (5) minutes for a total of ten (10) readings. The average of these readings should be 41°C ±1°C. Record the average value. If the unit is out of calibration, refer to *CALIBRATION* section (p. 18).
4. **Do not let the pump cool down.** Proceed directly to *Backup Limit Thermostat Test.*

9. BACKUP LIMIT THERMOSTAT TEST

1. With the pump operating properly at 41°C ±1°C, move the primary shorting switch to the *SHORT* position (see fig. 5, p. 21). This will short out the temperature controller and allow the pump to continue heating to the trip point of the backup limit thermostat(s).
2. Carefully observe the rising temperature and record the highest reading. When a thermostat opens, the pump will turn off, the *OVER TEMP* light will be lit, and the *HEATER INDICATOR* light on the test cover will turn off. (If the *OVER TEMP* light does not light and a thermostat has tripped, replace the light.) Either the *MANIFOLD* or *WELL* light on the test cover will be lit or both lights will be off, depending on which thermostats have tripped.
   - If the manifold thermostat light is on, then the manifold thermostat has opened. The temperature recorded must be between 43.3°C to 47.2°C. **If the thermostat operates outside its intended range, it must be replaced (see page 17).** Proceed to step 3, p.13.
   - If the well thermostat light is on, then the well thermostat has opened. The temperature recorded must be between 43.3°C to 50°C. **If the thermostat operates outside its intended range, it must be replaced (see page 17).** Proceed to step 3, p 13.
   - If neither light is on, then both thermostats have opened at the same temperature. To confirm this, toggle the thermostat shorting switch to the *MANIFOLD* position. (The *MANIFOLD* light should be on.) Next, toggle switch to the *WELL* position. (The *WELL* light should be on.) **If either thermostat opens outside its intended range as defined above, it must be replaced (see page 17).** Proceed to step 4, p. 13.

3. To test the remaining thermostat, toggle the limit thermostat shorting switch to the position corresponding to the non tripped thermostat. (This will short out the previously opened thermostat and allow the unit to continue heating.) Both thermostat indicator lights should be off and the *HEATER INDICATOR* light should be on. Carefully observe the rising temperature and record the highest reading. When the water temperature rises to the trip point of the remaining thermostat, the *OVER TEMP* light will be on, the pump will turn off, the heater indicator light will turn off, and the appropriate thermostat light will be on.
   - If the manifold thermostat light is on, then the manifold thermostat has opened. The temperature recorded must be between 43.3°C to 47.2°C. **If the thermostat operates outside its intended range, it must be replaced (see page 17).**
   - If the well thermostat light is on, then the well thermostat has opened. The temperature recorded must be between 43.3°C to 50°C. **If the thermostat operates outside its intended range, it must be replaced (see page 17).**
4. Unplug the unit, remove the test cover and proceed to *LEAK TEST*.

10. LEAK TEST

1. Immediately upon completion of Backup Limit Thermostat Test, reinstall fill cap tightly. Put your finger over the hole in the cap and tilt unit toward you so the front is down. Hold for three (3) minutes.
2. Return the unit to upright position and carefully check inside of tray and reservoir tray joint for leaks. Repeat process turning pump on back face. If leakage is found, refer to the *DISASSEMBLY/REASSEMBLY* section (pp. 15-17), and correct problem.

11. COVER AND FILL NECK GASKET REINSTALLATION

When reinstalling cover, be sure the fill neck gasket (fig. 9, item 6, p. 25) is in place. Push cover down as tightly as possible. Hold in place when tightening cover screws.

This completes the *FUNCTIONAL CHECK* procedure. Return pump to service if it is operating properly, or proceed to the *DISASSEMBLY/ REASSEMBLY* section pertaining to the problem(s).

Inspection forms vary from hospital to hospital. The following sample form is intended as a guide so that the important parameters are recorded.

⚠ DANGER

Risk of electric shock. Disconnect power before servicing the T/Pump.

⚠ WARNING

- Only qualified medical service personnel should repair the T/Pump. **Improper repair may result in death or serious injury, equipment damage, or malfunction.**
- Always perform the *FUNCTIONAL CHECK AND SAFETY INSPECTION* (pp. 9-13) after making repairs and before returning the T/Pump to patient use. Document your findings on the *INSPECTION FORM* (p. 14). **Improper repair may result in death or serious injury, equipment damage, or malfunction.**

⚠ CAUTION

Do not perform any powered tests with the reservoir empty. **Damage to the T/Pump may result.**

NOTE: All wires are terminated with slip-on connectors. When text says "remove wire," the slip-on connector is to be removed from the mating lug on the specific item.

COVER

1. Unscrew fill cap/valve assembly (fig. 9, item 1, p. 25) and remove. Unscrew plastic retainer.
2. Remove the four screws which retain the cover, two on each end of the pump.

   NOTE: When reinstalling the cover, do not forget to replace the fill neck gasket (fig. 9, item 6).

MOTOR

1. Place a screwdriver under fan hub (fig. 9, item 7, p. 25) and twist to remove fan.

   NOTE: When replacing the fan, make sure the hub is flush with top of motor shaft.
2. Remove green (w/yellow stripe) ground wire and orange and blue power wires.

   NOTE: To prevent breaking the motor lugs, support them when removing the slip-on lugs.
3. Remove the four retaining screws and washers on the top face of the motor.

4. It is necessary to remove the reservoir to remove the motor. Remove the eight (8) screws located around the inside wall of the tray. NOTE: It is not necessary to remove the front label (fig. 9, item 34). The front label is attached only to the tray and will slip off the reservoir.
5. Gently separate the reservoir from the tray. Do not damage the large O ring that seals the tray and reservoir.
6. Turn the tray on its backside (front label up). Place a screwdriver against the white impeller in the bottom of the pump housing to prevent the impeller from turning and remove the screw retaining the impeller. It is not necessary to remove the bottom housing (fig. 9, item 21) of the pump.
7. The impeller may now be slipped off the shaft. Return the tray assembly to an upright position. The motor may be removed by lifting straight up.
8. Center the new motor seal gasket over opening and insert new motor through seal. Replace impeller onto shaft and secure motor.
9. Do not overtorque the four (4) motor mounting screws. Torque value is 6.9 to 9.2 cm-kg.
10. If tray inserts are loose or motor mounts are worn, a new tray with sensor bracket should be installed.

HEATER

1. Remove the ground wire (green w/yellow stripe) and the two (2) heater wires (red and blue). NOTE: On reassembly, the red wire goes on to the front post of the heater.
2. Remove the three (3) nuts retaining the heater. The screws are retained in the tray. The heater can then be removed by raising and tilting the top of the heater toward the left side of the T/Pump.
3. Reassembly is the reverse of the above.
4. Do not forget to install heater gasket (fig. 9, item 11, p. 25).

PC BOARD

1. Using the plastic key (fig. 3, item 3, p. 7), turn the temperature indicator to the eleven o'clock position. The slotted coupling should then be positioned with the slot opening up.
2. Cut the plastic tie holding the wire bundle to the PC board. Remove the red, orange, and blue wires from the PC board.
3. Remove the two screws (fig. 9, items 53 & 54, p. 25) retaining the PC board. The board can then be raised from the tray, exposing the thermistor probe assembly in the brass manifold block (fig. 9, item 45). Use caution to be sure no strain is put on thermistor leads (fine white wires).
4. Carefully remove the thermistor capsule from the manifold. To avoid damaging the thermistor, do not pull on the wires. A dental pick or scribe can be used to pry the capsule out of the hole.

5. On reassembly, put a small quantity of silicone heat sink compound (Dow Corning #340 or equivalent) around the thermistor capsule. Carefully insert the thermistor capsule into the hole on the brass manifold block. To avoid damaging the thermistor, do not push on the wires. The capsule may be seated by placing needle nose pliers or tweezers on the edge of the capsule.
6. The remainder of the reassembly is the reverse of the above. Upon inserting the P. C. Board, the potentiometer shaft (fig. 9, item 49) must be in the vertical position to mate with the slot in the temperature indicator (fig. 9, item 37). Refer to *CALIBRATION* procedures (pp. 18-19).

MANIFOLD BACKUP LIMIT THERMOSTAT

1. Remove the two (2) wire lugs. Note the position of the color coded wires. Facing the front of the T/Pump, the purple wire goes on the left hand lug, and the orange wire goes on the right hand lug.
2. Remove the two (2) screws retaining the thermostat to the brass manifold block.
3. Reassembly is the reverse of the above.
4. Always be sure to check the backup limit thermostats according to the *FUNCTIONAL CHECK* (pp. 12-13).

WELL BACKUP LIMIT THERMOSTAT

NOTE: Do not attempt to replace the well thermostat. To insure proper operation of this thermostat, it is riveted and sealed to the tray assembly. Experience has proven that it cannot be successfully replaced. **If this item is defective, replace the entire tray assembly (fig. 9, item 15, p. 25).**

TRAY

1. Remove the eight (8) screws (fig. 9, item 14, p. 25) around the inside wall of the tray. Gently pry the reservoir from the tray.
2. Remove all components including seal, bushing, and clips from the old tray and reinstall into the new tray assembly.
3. Attach the reservoir to the tray. Check that the reservoir ring seal (fig. 9, item 16) is properly located in the groove in the tray. Install the eight (8) screws torqued to approximately 6 cm-kg.
4. Always be sure to check the backup limit thermostats according to the *FUNCTIONAL CHECK* (pp. 12-13).

⚠ DANGER

Risk of electric shock. Disconnect power before servicing the T/Pump.

⚠ WARNING

- Only qualified medical service personnel should repair the T/Pump. **Improper repair may result in death or serious injury, equipment damage, or malfunction.**
- Always perform the *FUNCTIONAL CHECK AND SAFETY INSPECTION* (pp. 9-13) after making repairs and before returning the T/Pump to patient use. Document your findings on the *INSPECTION FORM* (p. 14). **Improper repair may result in death or serious injury, equipment damage, or malfunction.**

⚠ CAUTION

Do not perform any powered tests with the reservoir empty. **Damage to the T/Pump may result.**

CALIBRATION EQUIPMENT

TPT9 ---------- GAYMAR Flow and Temperature Tester

TPC1 ---------- GAYMAR T/Pump Test Cover

TFC1 ---------- Thermometer, -2°C to 52°C, 1°C accuracy, 30 cm long, 7.5 cm immersion

Insulated alignment tool

T/Pad ---------- Any GAYMAR "12" or "22" series

The calibration should be performed in a temperature controlled room, between 21°C and 24°C.

CALIBRATION

1. Remove the pump cover by removing the two (2) screws at each end of the pump. The fill cap/valve assembly can be removed by unscrewing the cap and plastic retainer. The cover is now free to be removed.
2. Carefully remove the vinyl seal from the R3 trim pot (fig. 10, item 3, p. 29), located at the top right corner of the printed circuit board.
3. Install test cover. See *FUNCTIONAL CHECK* (p. 11) and fig. 5, p. 21.
4. Connect pump, pad, and TPT9 Flow and Temperature Tester according to fig. 6, p. 22.

5. Fill pump with room temperature distilled water.

6. Set Temp Dial to 41°C (maximum).

> **NOTE:** Be sure the temperature dial is always set to the maximum clockwise position when making calibration measurements and adjustments.

7. The primary shorting switch (fig. 5) on the test cover must be in the *OPEN* position. The backup limit thermostat shorting switch (fig. 5) must be in the *OPEN* position.

8. Turn unit on and allow to come to a steady temperature, approximately thirty (30) minutes.

   The *HEATER INDICATOR* on the cover should be on whenever the heater is on.

> **NOTE:** Flow must be 30 lph, minimum.
> If not, refer to *TROUBLESHOOTING* (p. 20).

9. Start recording the temperature readings every thirty (30) seconds for five (5) minutes for a total of ten (10) readings. The average of these readings should be 41°C ±1°C. If not, it will be necessary to adjust the R3 trim pot (fig. 5). This is accomplished by inserting an insulated alignment tool through the small hole in the left side of the TPC1 test cover. Turn the potentiometer screw clockwise to increase the water temperature. Turn the screw counterclockwise to decrease the water temperature.

   Do not force the adjusting screw past its stops.

10. After the final adjustment is made, let the unit run for one-half hour and recheck the calibration as described in step 9. The bandwidth should not exceed 1°C. Bandwidth is the difference between the maximum and minimum temperature excursions. If the *OVER TEMP* light is activated during the calibration adjustment, the water must be replaced with water 24°C or less and the calibration procedure repeated.

11. Without letting the pump cool, proceed directly to the Backup Limit Thermostat Test as outlined in the *FUNCTIONAL CHECK* (pp. 12-13). Record all results when recalibrating.

    Apply new vinyl seal after the trim pot has been adjusted properly.

PROBLEM	POSSIBLE CAUSE	REMEDY
"OVER TEMP" light is on.	1. Pad or hose is kinked. Hose clamps are closed.	Turn switch off, unplug pump, and dump water out. Unkink pad and/or hose. Open hose clamps. Refill with room temperature distilled water to proper level. Plug pump in, turn switch on, and wait 40 minutes.
	2. Water level is low, or reservoir is empty.	
	3. Pump is filled with water that is too hot (it must be below 24°C).	
	4. One of the backup limit thermostats has failed.	Unplug pump and install a test cover. Determine which thermostat has failed. Refer to Backup Limit Thermostat Tests (p. 12). Replace thermostat (p. 17).
	5. PC board (temperature controller) has failed.	Unplug pump, install test cover, and perform Calibration (pp. 18-19). Replace PC board as required (pp. 16-17).
	6 Motor failed	Replace motor.
T/Pump will not pump. ON/OFF switch pilot light is lit.	1. Water level is low, or reservoir is empty.	Refill with room temperature distilled water to proper level.
	2. "OVER TEMP" light is on.	Refer to "OVER TEMP" section above.
T/Pump will not pump. ON/OFF switch pilot light does not light.	1. The "ON" switch may not be fully engaged.	The light on the switch should be lit. Verify that the switch is fully engaged in the "ON" position.
	2. Power cord is not fully inserted into power entry module or grounded receptacle.	Insert the plug fully into the receptacle and power entry module.
	3. Fuse is blown.	Inspect for broken or disconnected internal wiring. Check for shorted components.
	4. Damaged cord or plug.	Check plug terminals. Check power cord continuity to breaker. NOTE: Flex cord while checking continuity. Replace power cord assembly as required.
T/Pump pumps OK, but will not heat.	1. Unit is tipped.	Place unit on level surface.
	2. Heater is not receiving power, or is defective.	Check if setpoint has been set too low. Remove cover and check power to heater. If power is present, heater is probably defective. Cold heater resistance is approximately 155 ohms. Replace if required. If there is no power at heater terminals, replace PC board.
	3. "OVER TEMP" light is on.	Refer to "OVER TEMP" section above.
T/Pump pumps OK, but ON/OFF switch pilot light does not light.	1. ON/OFF switch defective.	Replace ON/OFF switch. NOTE: Neon pilot light is not replaceable.
Flow rate is less than 30 lph.	1. Flow path is restricted or obstructed.	Be sure pump is at same level as pad, pad is flat, and water temperature is 41°C. (Flow is specified under these conditions.) Look for obstructions in the flow path. Open hose clamps. The orifice in the return hose fitting (fig. 9, item 43, p. 25) is the smallest hole.
	2. Motor is malfunctioning.	See #1 above. If flow path is clear, replace motor.
Current leakage is too high.	1. Heater will be the most probable cause.	Disconnect heater and check again. Replace heater if necessary. If current leakage remains high, continue disconnecting components until fault is located.
Resistance to ground failure (greater than 0.5 ohm)	1. Earth conductor connections within pump.	Check that connections are tight. If problem persists, check grounding wire to each component for continuity.
Water leaks from Clik-Tite connector.	The T/Pump must always be connected to a T/Pad or the hose ends must be joined together to prevent water flow leakage. If the connector leaks, check for:	
	1. Damaged O ring.	If defective, replace Clik-Tite connector.
	2. Locking ring on Clik-Tite connector is not snapped into place (see fig. 1, p. 3).	Snap Clik-Tite locking ring shut.

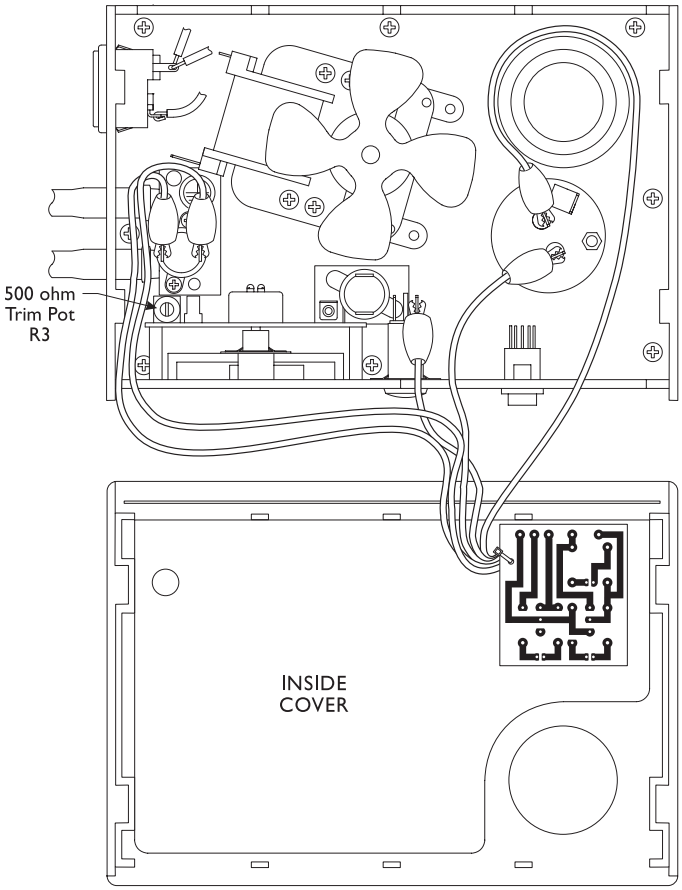
Figure 5 - TPC1 TEST COVER

⚠ CAUTION

Route TPC1 wires as shown to avoid interference with T/Pump fan motor.

NOTE:

Always match color of TPC1 wiring connections to color of T/Pump wiring.



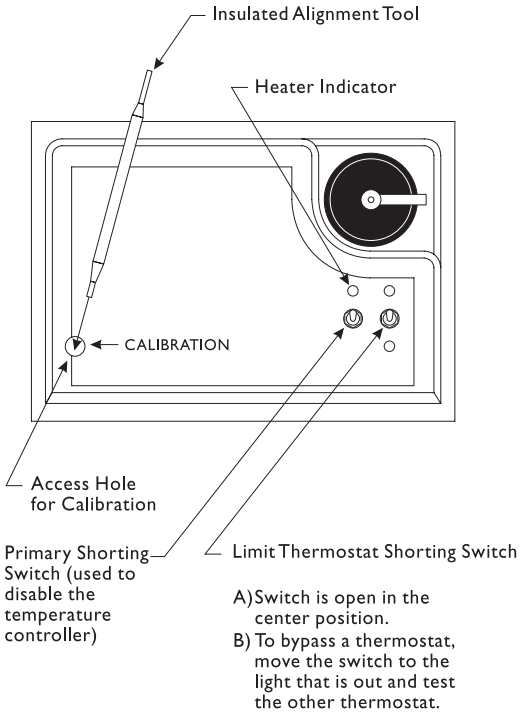
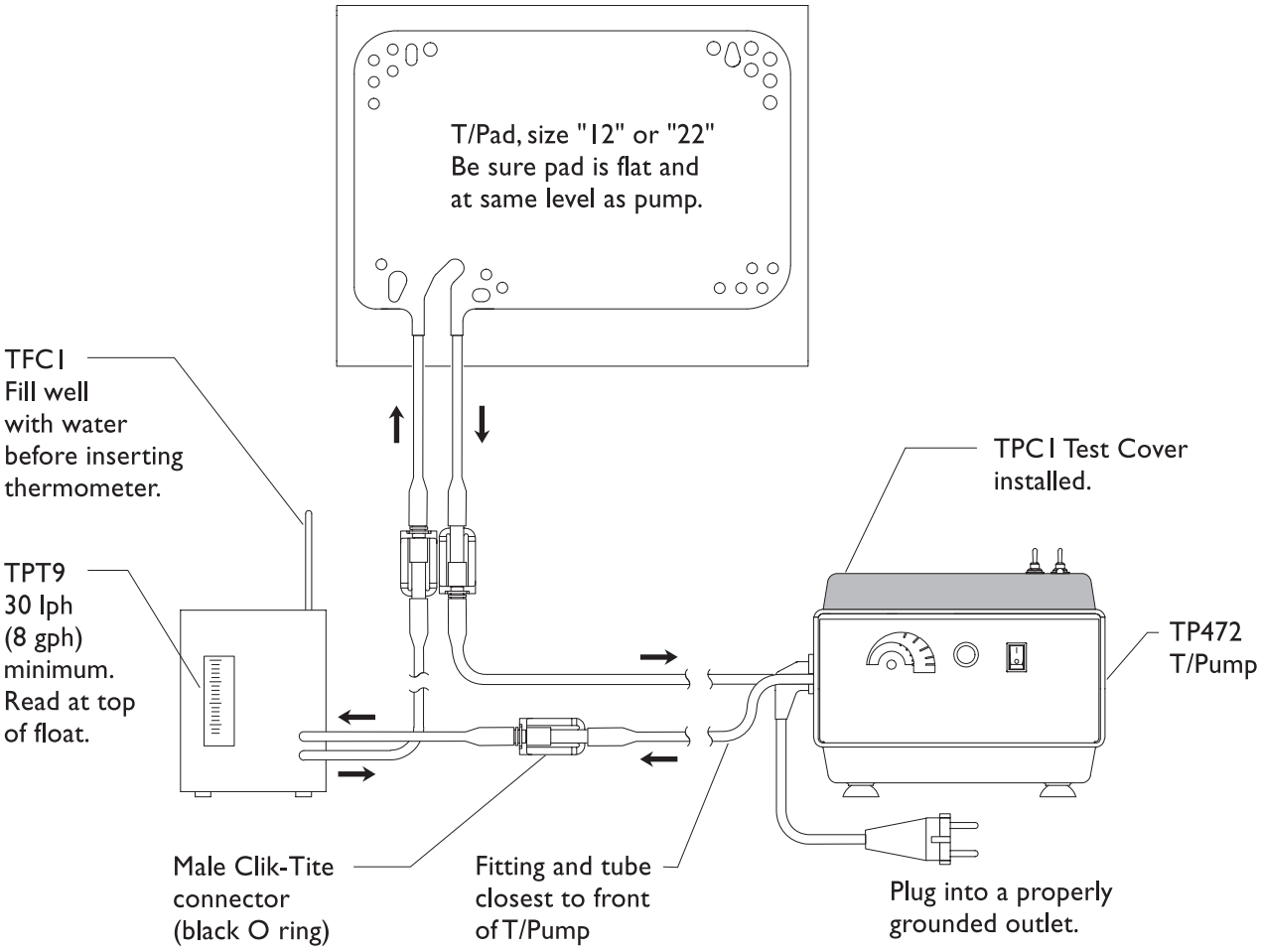
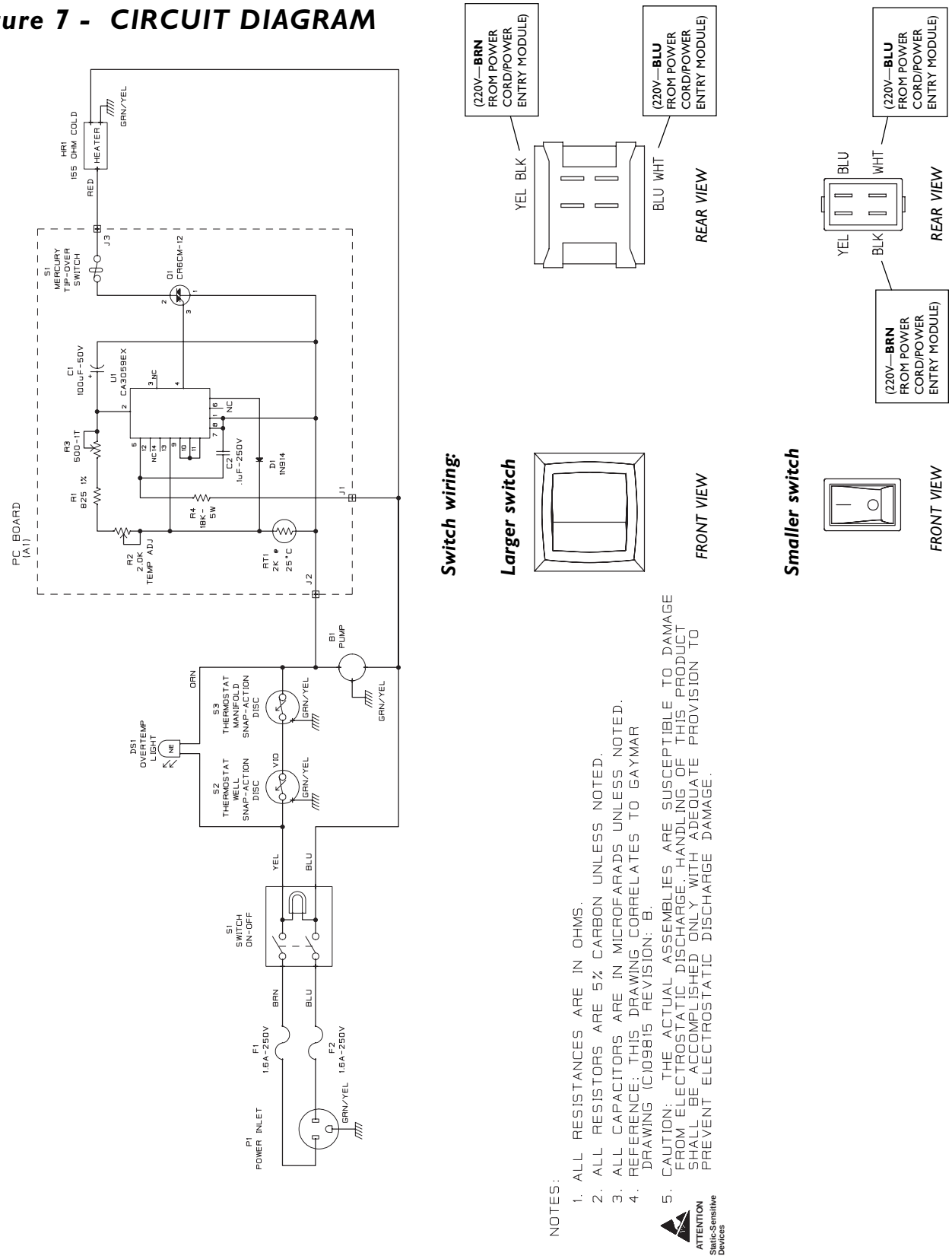


Figure 6 - FUNCTIONAL CHECK TEST DIAGRAM



NOTE:
If the flow meter is connected in reverse, no flow will be noted on the flow meter. Change the pump connections so that the male fitting (with black O ring) is on the supply side.

Figure 7 - CIRCUIT DIAGRAM



NOTES:

1. ALL RESISTANCES ARE IN OHMS.
2. ALL RESISTORS ARE 5% CARBON UNLESS NOTED.
3. ALL CAPACITORS ARE IN MICROFARADS UNLESS NOTED.
4. REFERENCE: THIS DRAWING CORRELATES TO GAYMAR DRAWING (C)09815 REVISION: B.
5. CAUTION: THE ACTUAL ASSEMBLIES ARE SUSCEPTIBLE TO DAMAGE FROM ELECTROSTATIC DISCHARGE. HANDLING OF THIS PRODUCT SHALL BE ACCOMPLISHED ONLY WITH ADEQUATE PROVISION TO PREVENT ELECTROSTATIC DISCHARGE DAMAGE.

ATTENTION Static-Sensitive Devices

Figure 8 - CIRCUIT DIAGRAM FOR TPC1 TEST COVER (P/N 06520-000; to connect, refer to figure 5)

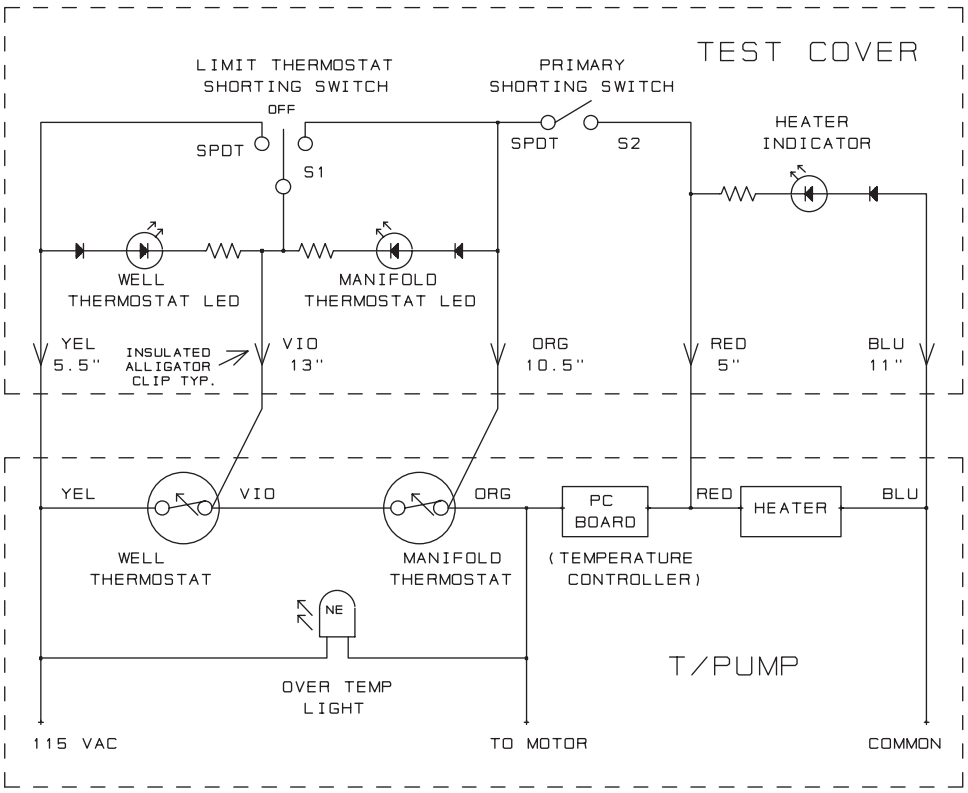
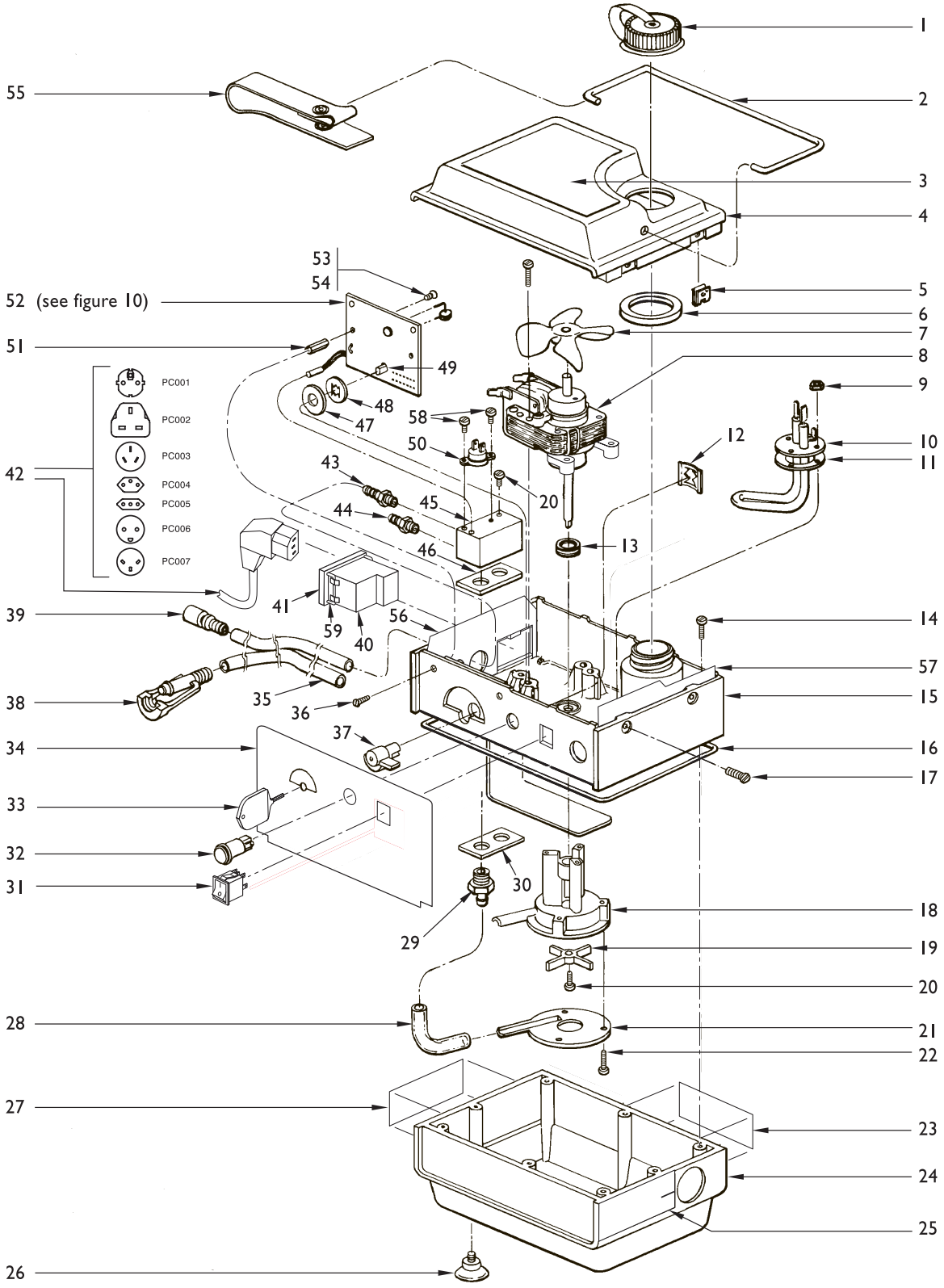


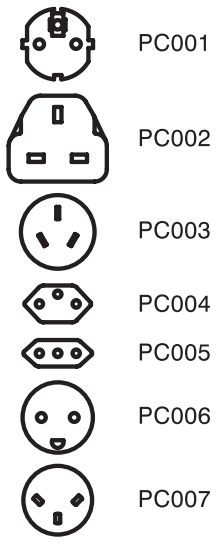
Figure 9 - EXPLODED VIEW



Item	P/N	Qty	Description
1	04553-003	1	Cap/Valve Assembly
2		1	Handle [Included with item 4]
3	09812-000	1	Contraindication Label [Included with item 4]
4	09695-000	1	Cover Assembly [includes items 2, 3, and 5]
5	90085-033	4	Fastener Clip [Included with item 4]
6	03650-000	1	Fill Gasket
7	04152-000	1	Fan
8	78096-000	1	Motor Kit [includes item 13]
9	91190-002	3	Nut, 6-32 SST
10	09663-000	1	Heater
11	05069-000	2	Heater Gasket
12	90085-003	1	OVER TEMP Light Clip
13	04877-000	1	Motor Seal Gasket [included with item 8]
14	91272-011	8	Screw, 6-20 x 5/8", type B, SST
15	78080-000	1	Tray w/Sensor Brkt, Thermostat* [includes item 31 and 34]
16	07968-000	1	Reservoir Seal
17	90018-059	4	Screw, 6-32 x 3/8", SST
18	03567-000	1	Pump Housing
19	03611-000	1	Impeller
20	90018-057	1	Screw, 6-32 x 1/4", SST
21	03568-000	1	Bottom Housing
22	90514-011	6	Screw, 6-20 x 5/8", type BT, SST
23		1	Serial Number Label [included w/ item 4; NOT AVAILABLE SEPARATELY]
24	78113-000	1	Reservoir (Replacement Kit) [includes items 16, 23, 25, 26, and 27]

* The well backup limit thermostat is part of the tray assembly.
Do not attempt to drill out the old thermostat. A leakproof installation is not possible.
Install tray assembly (see p. 17).

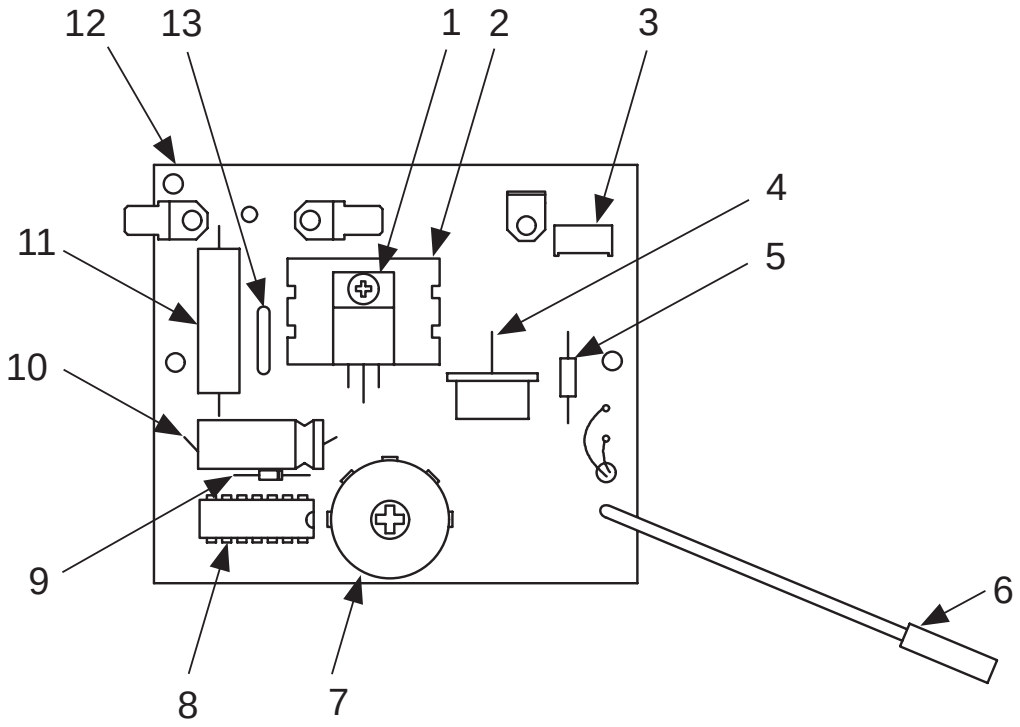
Item	P/N	Qty	Description
25	09808-000	1	Water Level Label [included with item 24]
26	90385-000	4	Suction Cup
27	10184-000	1	Ratings Label
28	81002-000	1	Tubing, 1/4" ID x 9 cm long
29	03394-000	2	Manifold Fitting
30	03881-000	1	Brass Bearing Washer
31	90342-004	1	Switch (250V) * [see note below]
32	91282-013	1	OVER TEMP Lamp with clip
33	03661-000	1	Temperature Adjust Key
34	11183-000	1	Front Label [included with item 15]
35	08086-000	1	Hose Assembly [includes items 38 and 39]
36	91275-027	2	Screw, 4-40 x 3/8", SST
37	03975-000	1	Indicator
38	03887-000	1	Male Clik-Tite [included with item 35]
39	03884-000	1	Female Clik-Tite [included with item 35]
40	09667-000	1	Power Entry Module/Fuseholder
41	90695-021	2	Fuse
42	PC001	1	Power Cord (Continental Europe)
	PC002	1	Power Cord (United Kingdom)
	PC003	1	Power Cord (Australia)
	PC004	1	Power Cord (Switzerland)
	PC005	1	Power Cord (Italy)
	PC006	1	Power Cord (Denmark)
	PC007	1	Power Cord (Israel)



* The large 250V switch used on the TP472 T/Pump is no longer available. When replacing this switch, replace the tray assembly (item 15) which includes the smaller switch.

Item	P/N	Qty	Description
43	03989-000	1	Hose Fitting (orificed)
44	03988-000	1	Hose Fitting (no orifice)
45	03983-000	1	Brass Manifold Block
46	03381-000	1	Manifold Gasket
47	90436-000	1	Fibre Washer
48	90085-015	1	Fastener Clip
49	03969-000	1	Potentiometer Shaft
50	78053-000	1	Backup Limit Thermostat (manifold)
51	90462-000	2	Spacer
52	77870-000	1	PC Board Assembly, includes thermistor
53	90139-004	2	Lockwasher, Internal
54	90018-025	2	Screw, 4-40 x 1/4", SST
55			Hose Strap [Included with item 4. NOT AVAILABLE SEPARATELY]
56	09849-001	1	Insulator Power Side
57	09849-000		Insulator Fill Side
58	91454-052	2	Screw - Fillister HD 6-32 x 1/4" LG SST
59	10097-000	1	Clip, Retaining
	TFC1	1	Thermometer [NOT SHOWN]
	TPC1	1	Test Cover [NOT SHOWN]
	TPT9	1	Flow and Temperature Test Tool [NOT SHOWN]
	TP20A	1	Bed Bracket

Figure 10 - PC BOARD



Item	P/N	Qty	Description
1	90586-000	1	Silicon Controlled Rectifier CR6CM-12
2			Heat Sink [Included with item 52. NOT AVAILABLE SEPARATELY]
3	90728-018	1	Potentiometer
4	03971-000	1	Mercury Switch
5	90092-391	1	Resistor, 825 ohm, 1/8W, 1%
6	06732-001	1	Thermistor
7	90728-127	1	Potentiometer
8	90886-031	1	IC CA3059E
9	90717-002	1	Diode, 1N914
10	90701-060	1	Capacitor, 100 µf, 50V
11	90092-441	1	Resistor, 18K ohm, 5W, 5%
12	77870-000	1	PC Board Assembly
13	90701-124	1	Capacitor, 0.1 µf, 250V

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